

Gulf of Mexico Hypoxia: Exploring Increasing Sensitivity to Nitrogen Loads

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Hypoxia is a critical issue in the Gulf of Mexico that has challenged management efforts in recent years by an increase in hypoxia sensitivity to nitrogen loads. Several mechanisms have been proposed to explain the recent increase in sensitivity. Two commonly cited mechanisms are bottom-water reducing conditions preventing nitrification and thus denitrification, leading to more N recycling and production of oxygen-consuming organic matter, and carryover of organic matter from previous years increasing oxygen demand, making the system more sensitive. We use models informed by these mechanisms and fit with Bayesian inference to explore changes in Gulf of Mexico hypoxia sensitivity. We show that a model including an of nutrient loading and recycling contributing to bottom water oxygen demand provides a good fit to observations and is not improved by explicit inclusion of organic matter carryover to subsequent years. Both models support two stepwise increases in system sensitivity during the period of record. This change in sensitivity has greatly increased the nutrient reduction needed to achieve the established hypoxia goal. If the Gulf remains at the current state of sensitivity, our analysis suggests a roughly 70% reduction of spring TN loads from the 1988-1996 average of 6083 ton/day may be required.